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# American Carbon Registry Update on Agricultural Protocol Development

***C-AGG Meeting  
Washington, DC  
November 3, 2011***





# Winrock International Institute for Agricultural Development

*Nonprofit that works in the U.S. and around the world to empower the disadvantaged, increase economic opportunity, and sustain natural resources*

- Formed in 1985 from 3 Rockefeller organizations: Winrock International Livestock Research and Training Center, International Agricultural Development Service , Agricultural Development Council
- Continued focus on agricultural and livestock improvement, food security, poverty alleviation, and climate change





# A focus on agriculture

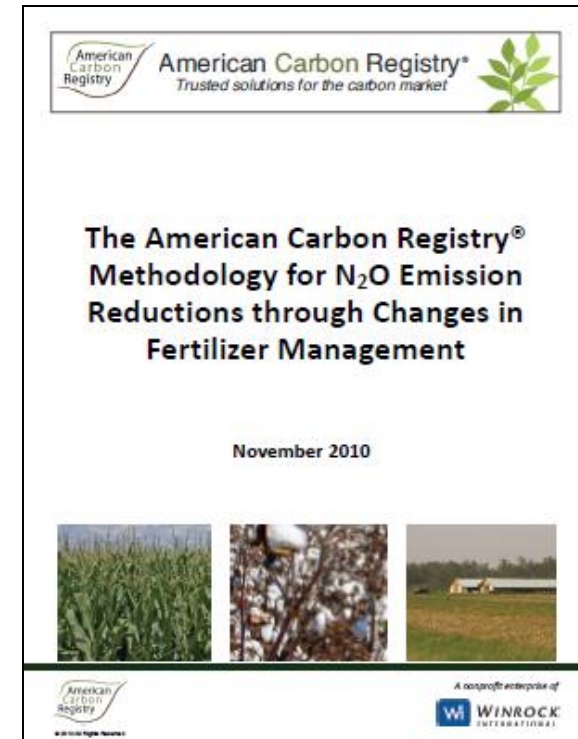
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- Reducing N<sub>2</sub>O emissions from fertilizer
  - ACR fertilizer methodology
  - MSU/EPRI methodology for fertilizer rate reduction
- Reducing GHG emissions in rice
  - California, Midsouth; later possibly international
- Livestock biodigesters
  - Combining GHG reductions with air quality improvements
- Livestock and grazing methodologies
- Work in China on agriculture and grasslands
- New England (fertilizer, on-farm energy efficiency, greenhouses, etc.)



# N<sub>2</sub>O reductions through changes in fertilizer management

- Applicable to any modified fertilizer practice
  - Change fertilizer type, timing, placement, rate, use timed-release fertilizers, nitrification inhibitors, other advanced technologies
  - No yield reduction
- No geographic or crop constraints
  - Model must be calibrated and validated
- Uses DNDC to calculate direct N<sub>2</sub>O emissions, and IPCC defaults for indirect N<sub>2</sub>O from leaching and volatilization, for baseline and project





# Testing in 3 CIg grants

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- **Delta Institute**
  - Real-world testing of two fertilizer protocols in IL, MI and OK
  - Efficient aggregation, data management, V/V, registration
- **Chesapeake Bay Foundation**
  - Region-specific, user-friendly version of DNDC
  - Test N<sub>2</sub>O benefits of soil testing/adaptive management, manure injection, and variable rate technology
- **The Fertilizer Institute**
  - Evaluate 4R nutrient stewardship for GHG offsets
  - Smart Nitrogen Application Program and Nitrogen Desktop
  - Test ACR, MSU, and Alberta protocols on corn/soy in IA and IL
- **Additional work in New England and California**



# Fertilizer offsets for California market

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- ARB voted to approve cap-and-trade regulation; offset supply short
- Strong interest in agricultural offset protocols
  - Potential supply... 0.5 MMT/y California, 20 MMT/y U.S.?
  - State has funded \$2.5 million in research on N<sub>2</sub>O from agricultural soils
- ACR fertilizer (and EDF rice) identified in ARB August 24 announcement as protocols under review for adoption in 2012
  - Early action / compliance offset protocol
  - Increases interest from investors/developers and potential revenues to farmers



# Preliminary thoughts one year on...

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- Science (field data and model cal/val) and protocols are strong and continue to expand
  - More cal/val expands scope and increases confidence
- Standardization possible but comes at a price
  - Performance standards for additionality
  - Run DNDC do derive EFs for different regions, crops, practices
  - Do cal/val up front and prescribe uncertainty adjustment
- User interface tools are needed
- On-the-ground demonstrations needed
  - Costs, benefits, risks, protocol usability, regulatory risk
  - Protocols evolve with producer feedback; regulators become more confident with real-world results



# **N<sub>2</sub>O reductions through fertilizer rate reduction (MSU/EPRI)**

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- Focuses on rate, as most reliable proxy for range of fertilizer changes
- Baseline = BAU fertilizer rate, calculated from producer-specific records or back-calculation from NASS crop yields and recommended yield goal rates
- Additionality (for U.S.): regulatory surplus and performance standard = any reduction from BAU
- Baseline and project emissions using Tier 2 equation for 12-state U.S. North Central Region, IPCC Tier 1 default factors elsewhere
- Assumes no yield reduction so no leakage deduction; no permanence buffer



# Rice Emission Reductions

## (EDF/Terra Global Capital/Applied Geosolutions/CA Rice Commission)

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- DNDC to model soil C dynamics, CH<sub>4</sub> and N<sub>2</sub>O emissions in baseline and project
- Pre-approved practices (CA only) → DNDC cal/val already done
  - Reduce winter flooding
  - Removal of rice straw after harvest
  - Dry seeding
  - ACR version allows for modular expansion (Midsouth U.S., Asia)
- Minimum 5 fields / 1,000 acres to reduce structural uncertainty
- Baseline: 5 year history of actual management on participating fields – subject to barrier analysis
- Additionality: three-prong test
- Uncertainty deduction and leakage adjustment; no reversals



# ***Demonstrating GHG Reductions in California and Midsouth Rice Production***

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- Based on EDF work with CA Rice Commission and Winrock 2010 outreach to rice growers
- Existing EDF protocol to be expanded to Midsouth
  - Writing module and doing DNDC cal/val
- AR pilot activities overlap but differ from CA
- Develop proof-of-concept user interface tool
- Assess waterfowl habitat impacts
- Evaluate replication potential in LA, MO, MS, TX
- Liaise with ARB on possible approval of a rice offset protocol



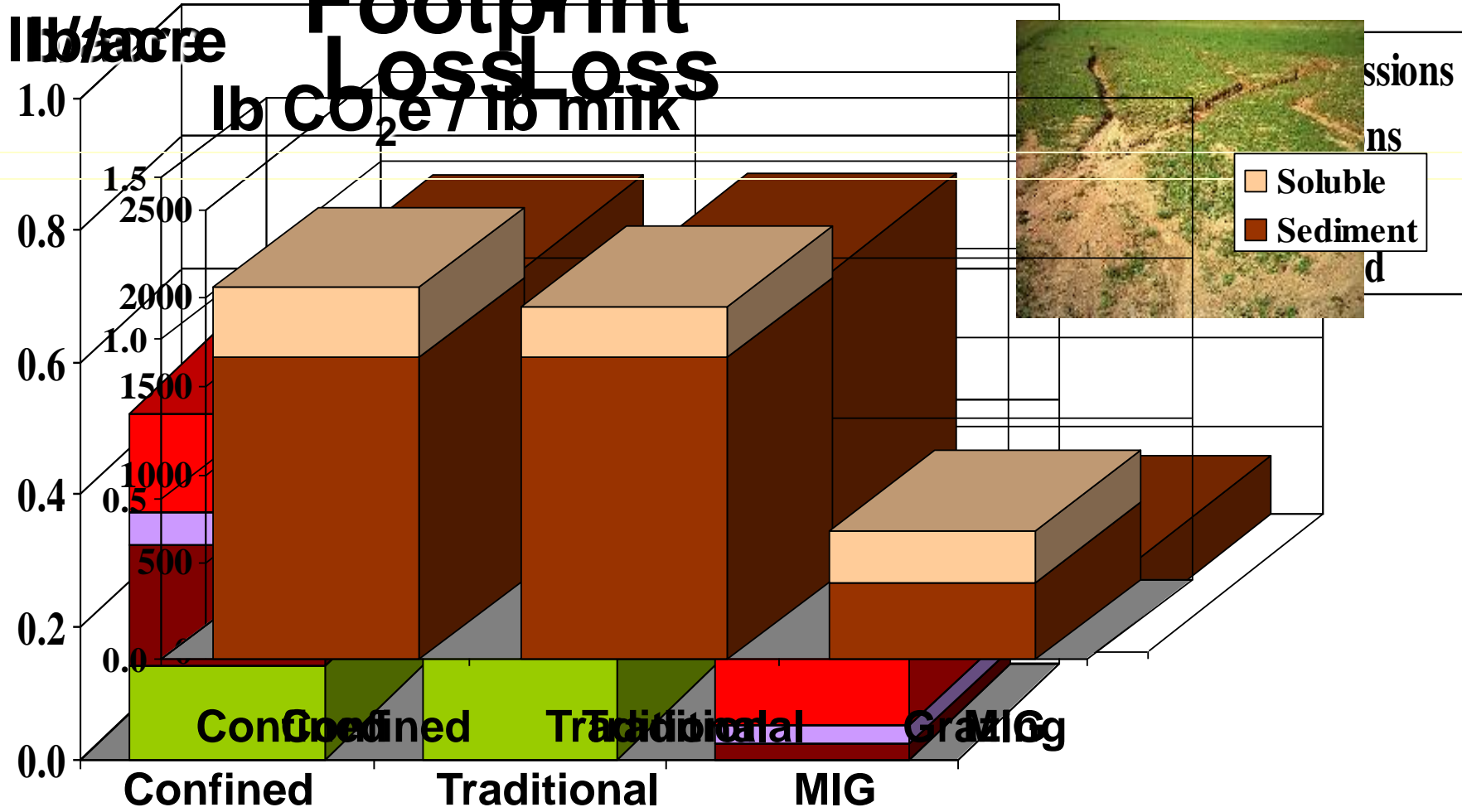
# Rotational grazing

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- Improve productivity and profitability; improve animal health; reduce GHG emissions and increase C sequestration; improve water quality and habitat
- Two pilot farms in Kazakhstan:
  - 60 head and 1,700 head operations
  - Milk production per cow up 42%, feed costs reduced 70%
  - Field days attract hundreds of farmers
- Vermont: how real an alternative to shifting to larger confinement feeding, or going out of business?
  - Surveys of traditional, MIG, and LMC operations
  - Compare P, N, sediment losses and C footprint

# Carbon Footprint Loss

## Phosphorus Sediment Loss





# Adapting Alberta beef and dairy protocols for U.S.

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- Beef feeding: including 4-6% edible oils in cattle feeding regimes to suppress methanogenesis
- Beef days-on-feed: reducing days on feed of cattle during finishing to reduce enteric and manure emissions
- Beef lifecycle: reducing culling age of cattle to reduce enteric and manure emissions
- Dairy cattle: various practices (throughout production chain) to reduce GHG emissions per unit milk produced



# Work in China

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- Wrote Panda AFOLU Standard
  - All agriculture, livestock/grazing, and forestry activities eligible
- Grassland re-vegetation methodology
  - Restore degraded grasslands with trees and grasses
- Changing livestock management
  - Changing feed regimes for enteric CH<sub>4</sub>, manure management, reduce fertilizer from the production, implement rotational grazing, sequester CO<sub>2</sub> in plants and soil
- Food security paramount
  - Reduce GHG intensity, maintain/increase yield, sell offsets
  - Strengthen measurement of poverty benefits



# Further information

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# DNDC model cal / val

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- Plant growth impacts soil water, C and N regimes, which determine biogeochemical reactions affecting  $N_2O$  emissions
- Calibration parameters:
  - Maximum crop biomass (kg C/ha), Biomass fractions (grain, leaves + stems, roots), Biomass C/N ratio (grain, leaves + stems, roots), Total N demand to reach maximum production (kg N/ha), Thermal degree days ( $^{\circ}C$ ), Water demand (g water/g dry matter)
- Use existing research, default values in DNDC crop library, or do own calibration
- Validation: comparison against measured fluxes



# N<sub>2</sub>O from fertilizer management

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- 22 crops already calibrated and validated in DNDC
  - Corn, winter wheat, spring wheat, soybean, sugarcane, barley, oats, alfalfa, sorghum, cotton, rye, papaya, potato, beets, paddy rice, upland rice, peanut, rapeseed, tobacco, millet, sunflower, beans
- 19 vegetable, 3 fruit, and 4 other crops calibrated for specific cultivars
- Calibration/validation studies underway in California for:
  - Corn, wheat, cotton, tomatoes, rice, alfalfa, lettuce, almonds, grapes, broccoli
  - ARB using DNDC for agricultural GHG inventory and calibrating for 6 vegetable, 8 fruit/nut, and 6 field/seed crops
- Several crops calibrated by Agriculture Canada



# Livestock manure digesters for GHG and PM reductions

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- Methodology based on 2 years work in California with USDA, CA Energy Commission, Inland Empire Utilities Agency, dairy/beef industry, and SCAQMD
  - Stakeholder workshops
  - Demonstration digester project with IEUA
  - Online tool
  - Monetize  $\text{NH}_3$  reductions as PM emission reduction credits
- Stack GHG offsets, RECs, and PM credits
- Air quality regs have limited digester projects
  - Can future protocols address net environmental benefits?